GUIDE FOR THE PREPARATION OF OPERATING AND SAFETY PROCEDURES FOR THE USE OF X-RAY DEVICES in PODIATRY FACILITIES

I. Introduction

Operating and safety procedures are required by HFS 157.74 Radiation Protection Code. The model procedures in this regulatory guide are generalized. You must write procedures that are specific for your facility. By using the sections of this guide that apply, you may create your unique set of operating and safety procedures. This guide may also be used to develop operating and safety procedures for facilities with mobile services. Individuals who are sole practitioners and sole operators and the only occupationally exposed individual are exempt and do not have to maintain operating and safety procedures. Although other formats are acceptable, information contained in this guide must be included in your operating and safety procedures.

The pertinent sections of HFS 157 that apply to podiatry practice are: Subchapter I, III, VIII, X, XI, XII. Within Subchapter VIII, HFS 157.74, .75, 77, and .86

The Code may be retrieved from the DFHS web site: http://www.dhfs.state.wi.us/dph_beh/BEH/Xray/index.htm

Any changes in the registration such as change of address or ownership, must be sent to the department within 30 days of the change. Change of ownership requires re-registration with full fees paid by the new owner. Addition of new equipment or the replacement of old equipment needs to be reported also. Changes to the registration information may be faxed to (608) 267-4799 or mailed to Division of Public Health, Radiation Protection Section, PO Box 2659, Madison WI 53701-2659

II. Sample Operating and Safety Procedures for Podiatry

OPERATING AND SAFETY PROCEDURES FOR

(Name of facility)_____

This guide establishes procedures that may minimize radiation exposure to patients and employees. They are provided to comply with regulations enforced by the Wisconsin Department of Health and Family Services, Radiation Protection Section. The regulations require that each x-ray facility be registered with the department and pay annual renewal fees.

A Radiation Safety Officer (RSO) should be designated. The RSO has the responsibility and authority for assuring safe radiation practices and serves as the contact person between this facility and the department. Direct all your questions or concerns on radiation safety to the RSO for this facility,
(specify name _____)

A. Operator Safety

1. ***Training Requirements for Operators of X-ray Machines***
All operators of x-ray machines must be trained to safely operate the equipment, use proper technique charts, be able to position the patient properly and to process the film properly. Each person should be trained in the proper operating procedures for each x-ray machine they will operate. New staff needs to acknowledge this training by signing-off on the form on Appendix A or similar record.

2. *Individual Radiation Monitoring Requirements HFS 157.25*

Monitoring devices may be obtained from:

Global Dosimetry Service	Landauer, Inc	Quantum Products
800-251-3331	800-323-8830	800-359-9686

If the office has documented previous employee monitoring and no employee received 0.5 mSv (500 mrem) then monitoring is not required. If the office has no record of previous monitoring, then monitoring devices should be issued for at least a year to determine occupational exposures.

Any adult who is likely to receive a dose from occupational exposure to radiation in excess of 5 mSv (500 millirem) in a year must use an individual monitoring device. Declared pregnant women who are likely to receive a dose from occupational exposure to radiation in excess of 0.5 mSv (50 mrem) during the entire pregnancy must also use an individual monitoring device.

If monitoring devices are worn, they shall be worn at the neck level or on the upper torso. If a protective apron is worn because the operator needs to be less than six feet from the tube or patient, the dosimeter needs to be worn at the collar outside the apron.

HFS 157.88 in Subchapter X discusses the requirements for notifying the employee of their monitoring results. Each employee who wears a monitor should be shown the monitor report and acknowledge seeing the results by initialing the report by their name. Social security numbers do not need to be used for identifying each employee. An employee number may be used for identification.

Records of employee exposure must be retained, even after the employee has left. Upon departure, each employee must receive a copy of their final monitoring report that shows their exposure for the entire employment period. The information on the periodic monitor report may be recorded on facility letterhead and include the phrase "This report is furnished to you under the provisions of Wisconsin Administrative Code, Chapter HFS 157, Radiation Protection. You should retain this report for future reference".

a. Individual monitoring devices must be worn at the unshielded location of the whole body likely to receive the highest exposure. When a protective apron is worn, the location of the individual monitoring device is typically at the neck (collar) [HFS 157.25(3)].

b. Additional individual monitoring devices used for monitoring the dose to the embryo/fetus of a declared pregnant woman must be located at the waist and under any protective apron being worn by the declared pregnant worker.

c. The individual monitoring device shall be assigned to and must be worn only by one individual.

d. If multiple individual monitoring devices are worn by a declared pregnant woman, dose to the embryo/fetus and the occupational dose to the woman shall be determined in accordance with HFS 157.25(3)(b). (1.5 X the waist badge + 0.04 X the collar badge)

e. Individual monitoring devices that are not being worn and the control monitoring device will be stored in an area that is away from rooms where radiation machines are in use. This is in/at (specify location) .

f. (specify name) is responsible for the occupational dose records and exchanging the individual monitoring devices on - (specify exchange dates) . The individual monitoring device readings (film badge reports) are located in/at (specify posting or records location) .

g. If you are working for another employer and receive an occupational dose, you should report that dose to the RSO so that it can be included in your annual record of occupational dose.

3. Dose to Pregnant Operators

a. Occupational dose limits are found in s. HFS 157.22 in Subchapter III. If any employee is pregnant or becomes pregnant, she may voluntarily inform the Radiation Safety Officer (RSO) or employer in writing of the pregnancy. If the RSO or employer is informed of the pregnancy, the employer must ensure that the dose to the embryo or fetus does not exceed 5 mSv (500 mrem) during the entire pregnancy and no more than 0.5 mSv (50 mrem) in any month. The dose to the monitoring device worn at the waist level is considered to be the fetal dose. Declared pregnant workers shall be monitored for radiation exposure. If the employee chooses to wear a leaded apron and have dosimetry, two monitors are recommended; one device will be worn at the neck and the second under the apron at the waist level. If an apron is not worn, only one monitor may be assigned and that shall be worn at the waist level.

   If an employee does not declare their pregnancy in writing, for radiation safety purposes they are not considered to be pregnant and the 50 mSv (5 Rem) occupational exposure limit applies.

4. Use of Protective Devices

a. Use protective devices, such as lead aprons, gloves, and shields, to reduce exposure to radiation and keep radiation exposure as low as reasonably achievable (ALARA). Protective devices must be used or provided in the following situations:

(i) when it is necessary for an individual other than the patient to remain in the room or hold a patient.

(ii) Other_____

b. Protective gloves and aprons is/are stored in/at (specify location)_____.

c. Protective devices shall be checked annually for defects, such as holes, cracks, or tears. This check can be done by visually inspecting or feeling the protective devices or may also be done by x-raying these items. A record will be kept of this check [See Appendix C]. If a defect is found at the time of the annual check or on any other occasion, notify the RSO and remove the device from service until it can be repaired or replaced. Protective devices should be radiographed and the interpreting physician reviews the films for defects in the devices.

5. Holding of patients and/or film

a. If a patient or film must be supported during a radiation procedure, use a mechanical holding device when circumstances permit. Mechanical devices cannot be routinely used during the following situations in this facility.

(1) (List situations)_____

(2)_____

(3)_____

b. If it becomes necessary for an individual to hold a patient or film, the holder shall not be pregnant. They must wear protective devices, must be monitored and keep out of the direct beam.

6. Posting Notices, Instructions, and Reports to Workers

a. Employees must read the "Notice to Employees" sign posted in/at (specify location}_____The "Notice to Employees" form can be printed from the DHFS web site at: http://www.dhfs.state.wi.us/dph_beh/BEH/Xray/index.htm. (The form can be accessed on the left-hand column on that screen under Publications.) The form needs to be posted on an employee bulletin board or employee accessible area. This is located at _____.

b. The certificate of registration, issued annually at the time of registration renewal, the operating and safety procedures and any notices of violations involving radiological working conditions are located in/at (specify location's)_____.

c. Your rights and obligations as a radiation worker are found in HFS 157.88, a copy of which may be found at

(specify location)_____.

7. Radiation Incident or Overexposure

If you suspect there has been an excessive exposure or a radiation incident such as unintentional exposure of yourself or another employee, immediately notify the RSO or employer.

Top Ten Dosimeter Do's and Don'ts

- **DO WEAR IT** when working. It has no value in your locker or purse.
- **DON'T WEAR IT** when you are receiving x-rays for your own health care.
- **DON'T WEAR IT** away from the workplace.
- **DON'T WEAR IT** under your apron unless you are wearing two dosimeters. Leave your dosimeter in the same place every day when you leave work so you know where it is.
- **DO TURN IT IN** on time. Time gaps make analysis more difficult, less accurate and reduces legal and historical value of the reports.
- **DO PLACE** the control dosimeter in a radiation-safe area; the dose to the control is subtracted from each dosimeter and needs to be accurate.
- **DO REPORT LOST OR DAMAGED** dosimeters immediately. Prevent damage by not leaving your dosimeter in areas of high temperature such as your dashboard or in the clothes dryer.
- **DON'T PLACE** a dosimeter in an area for testing of stray radiation. Additional dosimeters can be assigned for testing.
- **DON'T SHARE** dosimeters; this is illegal. An average total for a shared dosimeter is meaningless to each individual.
- **DON'T TAMPER** with your dosimeter or anyone else's. The reports are legal documents and are regarded as real exposures received. Tampering with dosimeters is grounds for dismissal.

8. Multiple Employers

If an employee works in more than one facility and wears a dosimeter in each facility, each *employee* is responsible for reporting their exposure from each job to each employer. The cumulative exposure from each job is the occupational exposure limit. No employee is allowed to receive more than 50 mSv (5 rem) in a calendar year from all employment during that year.

C. Operation of the X-ray Machine

X-ray machines in podiatry offices shall be located so that the exposure to employees and the public is minimized. Podiatry x-rays are taken in a down and cross-table position. The cross-table position has the greatest potential for unintentional exposure to employees or the public. Proper placement of the x-ray system will prevent unintentional exposure.

1. Ordering of X-ray Exams

No x-ray exams shall be taken unless ordered by a licensed practitioner, including nurse practitioner and physician assistant. This may be a verbal order so long as there is a corresponding entry into the patient chart or computer file.

2. Operator Location During Exposure

All operators shall be trained in the proper use of the x-ray equipment. This includes location during exposures. The operator needs to be at least six feet from the patient and not in the direction that the tube is pointed for the cross-table lateral film. This can be accomplished with a long exposure cord.

3. Use of a Technique Chart

Technique charts are required for systems with adjustable techniques, such as kV, time or pulses and mA (x-ray tube current) or mAs. Use of a technique chart aides in reducing the exposure to the operator and patient by providing a standard technique for a given machine regardless of the operator. Technique charts are displayed in the vicinity of the control panel of each x-ray machine. None screen imaging system shall not be used. Fine detail screens provide high detail and reduce the patient and operator exposure.

Electronic technique charts are acceptable.

4. Restriction and Alignment of the Beam

The useful x-ray beam shall be restricted to the area of clinical interest. Use the centering and beam-limiting devices (collimator) provided on the x-ray machine. Units with apertures to restrict the beam size must have a means to center the x-ray beam to the image receptor.

5. Use of Mobile or Portable Machines

(Mobile x-ray equipment is mounted on a permanent base with wheels and/or casters for moving while completely assembled and portable x-ray equipment is designed to be hand-carried)

a. During the exposure the operator:

(i) must be positioned so that his/her exposure is as low as reasonably achievable (ALARA) (e.g. 6 feet or more away); and/or

(ii) must wear lead apron, gloves if necessary, or be protected by other shielding and

(iii) should never be in line with the direct beam.

b. An individual during any radiographic exposure shall not hold the x-ray tube housing. There is the danger of electric shock by holding the tube housing during the exposure.

6. ***Patient Safety***

Patient radiation safety practices include:

1. Using the lowest possible radiation exposure for each exam by using the fastest film speed and the shortest exposure time. Podiatry offices shall not use "ready-pack", unless they have an intensifying screen or cardboard film envelopes.

2. Avoiding repeat x-rays by setting the correct technique

3. Positioning the tube and film carefully

4. Provide gonad reproductive organ protection for patients of child bearing age unless the shield interferes with the exam.

7. Film Processing [See Appendix B for sample record chart for the darkroom and Appendix D for processor testing instructions]

a. Unexposed film is stored (describe location for storage)_____
Unexposed film should be stored according to the film manufacturer instructions. This is usually in a temperature and humidity controlled location.

b. Films shall be developed by the time and temperature recommended by the x-ray film manufacturer. These specifications are posted in/at (specify location)_____.
(This is usually near the processor in the darkroom)

(i) Check the temperature at the beginning of the workday using a thermometer that does not contain mercury. Do not process films unless the developer temperature is (specify temperature)_____

(ii) Manual processing temperature should be checked throughout the workday.

(ii) For automatic processors, run blank films through the processor at the beginning of the workday.

c. Expiration dates on film and chemicals should be checked periodically. New film or chemicals should be rotated so the oldest are used first. Do not use films or chemicals after the expiration date.

d. Chemicals will be replaced by (specify name)_____according to the manufacturer's or chemical supplier's recommended interval, which is (specify frequency)_____, or no longer than once per month.

e. Safe light(s) in the film processing/loading area is/are provided under these conditions and should not be changed without authorization from the RSO.

Filter type_____
Bulb wattage _____
Distance from work surfaces _____

f. If you see light leaks around doors, ceilings, or other openings in the darkroom, notify the RSO.

8. Processor Quality Control

Podiatry facilities are required to test the processing stability at least once per week.

a. Processing systems shall be tested for chemical activity at least once per week.

b. The test shall consist of a density test using densitometer/sensitometer or pentrometer tools following the procedures described in Appendix D.

APPENDIX A

SAMPLE RECORD FOR INSTRUCTION OF INDIVIDUALS IN OPERATING AND SAFETY PROCEDURES FOR

(name of facility)

These procedures have been made available to each individual who operates the x-ray equipment on the date(s) indicated.

(Signature of RSO) (Date)

Equipment Operator Statement:

I have read these procedures and agree to abide by them.

(Signature of Equipment Operator) (Date)

(Signature of Equipment Operator) (Date)

(Signature of Equipment Operator) (Date)

(Signature of Equipment Operator) (Date)

(Signature of Equipment Operator) (Date)

(Signature of Equipment Operator) (Date)

APPENDIX B

SAMPLE DARKROOM REQUIREMENTS LOG FOR CALENDER YEAR

Automatic processor (Model #_____, Serial #_____) OR
Manual processing

Developer temperature _____

Chemicals replaced
(Manufacturer's or chemical supplier's recommendations or every 3 months)

(initials)_____(date) _____

(initials)_____(date) _____

(initials)_____ (date) _____

(initials)_____(date)_____

Darkroom light leak tests performed (every 6 months)

(initials)_____ (date) _____

(initials) _____(date) _____

Lighting checked in film processing/loading area:

filter type _____
bulb wattage _____
distance from work surfaces _____ inches

(initials)_____(date)_____

(initials)_____ (date) _____

Light leaks or related deficiencies noted
(initials)_____(date) _____

(initials)_____(date) _____

Corrections of light leaks or related deficiencies (or attach service/work orders)

(initials)_____ (date)_____

APPENDIX C

SAMPLE PROTECTIVE DEVICES SURVEY (LEAD APRONS, GLOVES, THYROID SHIELDS, GONADAL SHIELDS) List types of defects such as tears, holes, sagging lead, etc.

ID#	DEFECTS	INITIAL of PERSON	DATE INSPECTED

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Appendix D

Film processing test procedures

Automatic Film Processors

Processing conditions must be tested before processing patient films or at least once per week. The test consists of exposing film to a known intensity of light, processing the film and comparing the film to a known standard. Under processed or over processed films can lead to misdiagnosis, excessive patient exposure and increased operating costs. Properly exposed and processed films are required for proper patient care. Over exposing the patient to radiation and under processing the film is a serious problem.

There are two methods which may be used for this testing:

A. Sensitometer/densitometer

B. Pentrometer (Step Wedge)

Put fresh chemistry into the processor and mix fresh chemistry for the replenishment tanks if provided. For small tabletop processors, operate the processor for two days to season the chemistry. For larger processors, operate the processor for five days. Seasoned chemistry is more stable than fresh chemistry and will give a more consistent test result. Seasoning requires about 5 14"x17" equivalent films for small processors and 25 for larger processors. Double the number of films for smaller sizes.

A. Sensitometer/densitometer method.

1. A sensitometer is a device designed to expose one or both surfaces of the film to a preset light source, imprinting an image of graduated density steps on the film.

2. A densitometer is a device designed to pass light through the processed film and measure the intensity of the light as it passes through the graduated density steps on the processed film.

3. By charting the density of specified steps, the operator can determine whether the processor has changed since the last test. If the processor has changed by more than an acceptable amount, usually one step on a 21-step sensitometer or 0.15 density, then a determination of the cause of the change needs to be made before patient films can be processed. A processor must be within control specifications established by the test procedure before patient films are processed.

4. Establishing a correct baseline is critical to the proper testing. The following steps can be used to establish your baseline charts:

a. Needed tools:

   1. Thermometer. This should be a non-mercury thermometer, either electronic or dial type capable of determining temperature of the developer to within 0.5 degree F. A common fever thermometer can be obtained at any variety store. These have sufficient range and accuracy to be used for testing the processor developer temperature. Thermometers in processors are seldom accurate or consistent. You need to verify the actual temperature and make adjustments accordingly.
   2. A simulated light source (sensitometer) that is capable of exposing the film using either blue or green light.

3. A densitometer to measure density of the film.
4. Quality control film. This box of film should be used exclusively for quality control. It must be the same *type* of film you use for your patient exams. If you routinely use only 14X17 film, the QC film may be 8X10 so long as it is the same type of film. Also, film is either blue sensitive or green sensitive, depending on the type of screens you use in your cassettes. You must use film that is compatible with your screens for proper exposure. If you do not know what screens you have, contact your x-ray service supplier.
5. Processor quality control charts. These charts are useful tools for graphically plotting the QC values and determining trends or out of control values. Charts generally come with the QC kits and a sample is attached to this packet.

b. The sensitometer is used to expose your test film.

1. Set the "blue/green" switch to the type of film you are using. In the darkroom with the lights off, insert the edge of the film into the slot on the sensitometer. Some are a "clam shell" design and you press the top down onto the film to activate the light source. Rotate the film 180 degrees and expose the opposite edge of the film.
2. Some films are more sensitive on one side of the film and exposing opposite sides will invalidate the results. If you turn the film over and expose the ends of the film rather than the long edges, if one side of the film differs significantly from the other. Always use the same side to measure the density. You can choose the high reading side or the low reading side but you must be consistent. You must always use the same side of the film for testing. Always orient the film box the same way when removing the film. Mark one side to the box with a heavy marker and always keep that side up or down when removing the film from the box.
3. Process the film by placing the film on the feed tray. Always place the film on the same side of the feed tray and always have the same side of the film facing up. Sensitometry films must be processed each day for five days to establish your "Aim Points".
4. When the film comes out of the processor, measure the density as follows:
    a. Measure the density of the steps numbers 8 to 14 on each of the exposed strips on each film. Record the values and average the value for each film at each density step.
    b. Add the five values for each film on each step and divide by five to obtain the average for all five days.
    c. Determine which step will be used for the speed or Mid Density (MD) value by selecting the step that is closed to a density value of 1.20 but not less than 1.10. This can be over 1.20. Plot this point on the chart at the MD line and write this value on the chart.
    d. Next, select the density steps that will be used to determine the contrast or Density Difference (DD) value. Select the density step with a value of not more than 2.20. Then, select the density step with a value of not less than 0.45. Subtract the lower value from the higher value to determine the DD. Record the density step numbers and the density difference on the chart on the line that represents the operating level for contrast.
    e. Measure the base plus fog value by measuring the density in an unexposed portion of the film. If this value exceeds 0.23, you may have a darkroom fog problem with light leaks or improper safe lights.
    f. Establish control limits for speed (MD), contrast (DD) and base plus fog. For the MD and DD values, the range should be +/- 0.20 density and for base plus fog should be no greater than 0.03.
    g. Developer temperature can also be plotted on the charts.

Once the chart has been established, each test film must be plotted on a QC chart before the patient films are processed for that day. If the processor is "out of control", determine the cause and correct the problems before processing the patient film. This may require adjusting the temperature or adding fresh chemistry. Small table-top processors are more prone to fluctuations than larger models.

Write the date of each test on the chart. QC films need to be processed only on days when patient films are being processed.

B. Pentrometer method (Step Wedge)

Tools needed

1. Pentrometer
2. Thermometer
3. Densitometer (preferred but not required)

This test method may be used in facilities with low workloads, processing less than one set of patient films per day, on average. A densitometer should also be acquired to measure the base plus fog values to determine whether there are any light leaks in the darkroom. If inspection results by the department inspectors show that this method is ineffective, facilities will be required to obtain the test tools for the sensitometer/densitometer method.

A pentrometer is a metal wedge with at least eleven or 21 steps cut into the metal. Steps are numbered with a lead number. The pentrometer method is less precise than the densitometer because it relies on "eyeball" comparisons of the density of the wedge.

To perform this test using seasoned chemistry, do the following:

1. Determine the proper exposure technique from the literature that came with the wedge. If no information came with the wedge, the technique will usually be about 70 kV at 3-5 mAs (100 mA, 1/30 to 1/20 sec) when the wedge is placed directly on the cassette and not in the buckey tray.
2. Always use the same cassette for making the exposure.
3. Always use the same distance from the x-ray tube to the cassette.
4. Place the wedge in the center of the cassette on the base unit to the machine, as you would for an AP foot film and expose. Use a technique of about 70 kV at 3-5 mAs. This would be 1/30 to 1/20 second at 100 mA or the equivalent.
5. Make sure the processor is up to temperature before processing the film.
6. Process the film according the film manufacturers instructions. Always feed the film into the processor on the same side of the feed tray.
7. Reserve this first film as your "master" film and date it with the processing date. Cut the film in half down the length of the image of the step wedge.
8. Perform the test again the next time you are going to process patient films. Cut this film in half down the length of the wedge.
9. Place both films on a view box with the two cut edges together.
10. Align the top or bottom step of each image.
11. If the daily test image is off by more than one density step from the master image, make adjustments to the processor and perform the test again until the films match.
12. When the films match, the patient film may be processed.
13. DO NOT ALTER THE TECHNIQUE TO MAKE THE TWO FILMS MATCH. THIS DEFEATS THE PURPOSE OF THE TEST!

Each time you change the chemistry in the processor, the master film must be recreated. Some small processors may require new chemistry every two weeks. The purpose of the "master" film is to give a comparison value for each new batch of chemistry.

APPENDIX E

Densitometer and Sensitometer Suppliers

HFS 157.74(3) requires medical facilities to conduct processor testing prior to the processing of patient films on days when x-ray exams are performed. Podiatry and dental facilities are required to test once a week.

The following lists of suppliers have equipment designed for testing processors to determine whether it is safe to process patient films. This list is not inclusive.

ESECO
One ESECO Rd
Cushing OK 74023-9912
800-331-5904
http://www.eseco-speedmaster.com/

Speedmaster – SM-12 Pocket Pal Densitometer
Speed Light SL-2 Sensitometer
PT-11 Pentrometer

Fluke Bio Medical
Voice: 516.870.0100
Toll Free: 888.466.8257
http://www.flukebiomedical.com/rms/content/med-image/diag-image/index.asp?dvv=2Fax: 516.870.0140

07-417 Hand-Held, Dual-Color Sensitometer

07-443 Hand-Held Deluxe Digital Clamshell Densitometer,

X-Rite Corporation
http://www.xrite.com/

X-Rite, Incorporated
3100 44th Street, S.W.
Grandville, Michigan 49418 USA
Phone: 616-534-7663
Fax: 616-534-8960

X-Rite 331 Portable Transmission Densitometer
Transmission densitometer designed to maintain quality control of black and white film processing

X-Rite 334 Portable Dual-Color Sensitometer
Dual-Color Sensitometer for monitoring x-ray film processors

WARNING: Mention of a product, company or service does not constitute an endorsement by the department but only serves to present information regarding the types of devices or services available to the user. Contact your local x-ray service company or film supplier for further information.

APPENDIX F

Radiation Monitoring Suppliers

Radiation monitoring devices may be obtained from:

Global Dosimetry Service	Landauer, Inc	Quantum Products
800-251-3331	800-323-8830	800-359-9686

WARNING: Mention of a product, company or service does not constitute an endorsement by the Department of Health and Family Services but only serves to present information regarding the types of devices or services available to the user. Contact these vendors or your local x-ray service company or film supplier for further information.

APPENDIX G

Hand Film Processing Time and Temperature Chart

The temperature of each solution shall be maintained within the range of 60 ºF to 80 ºF (16 ºC to 27 ºC). Film shall be developed in accordance with the time-temperature relationships specified by the film manufacturer or, in the absence of such recommendations by the film manufacturer, with the following time temperature chart:

TIME-TEMPERATURE CHART

Thermometer Reading Minimum Immersion Time in the Developer

ºC	ºF	minutes
26.7	80	2
26.1	79	2
25.6	78	2 ½
25.0	77	2 ½
24.4	76	3
23.9	75	3
23.3	74	3 ½
22.8	73	3 ½
22.2	72	4
21.7	71	4
21.1	70	4 ½
20.6	69	4 ½
20.0	68	5
19.4	67	5 ½
18.9	66	5 ½
18.3	65	6
17.8	64	6 ½
17.2	63	7
16.7	62	8
16.1	61	8 ½
15.6	60	9 ½

The non-mercury thermometer shall Indicate the actual temperature of the developer to within +/- 0.5 ^{0}F

The timer shall signal the passage of a preset time as short as two minutes.

Film should be rinsed between the developer and fixer.

Immersion time in the fixer is usually twice that of the developer

A minimum of 15 minutes in flowing water is required for proper washing